

# INVESTIGATOR'S ANNUAL REPORT

## National Park Service

All or some of the information provided may be available to the public

<b>Reporting Year:</b> 2005	<b>Park:</b> Glacier Bay NP & PRES
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<b>Permit #:</b> GLBA-2004-SCI-0005	
<b>Park-assigned Study Id.#:</b> GLBA-00058	
<b>Study Title:</b> Glacier Bay Oceanographic Patterns	
<b>Permit Start Date:</b> Mar 01, 2004	<b>Permit End Date:</b> Dec 31, 2010
<b>Study Start Date:</b> Mar 01, 2004	<b>Study End Date:</b> Dec 31, 2010
<b>Study Status:</b> Continuing	
<b>Activity Type:</b> Monitoring	
<b>Objectives:</b> <p>The oceanographic patterns within Glacier Bay drive a large portion of the spatial and temporal variability of the ecosystem. A program that monitors oceanographic patterns is essential for understanding the marine ecosystem and to differentiate between natural variation and anthropogenic disturbance. The objective of this project is to understand the spatial and temporal (seasonal and yearly) variation in a variety of oceanographic parameters, including salinity, temperature, stratification, light levels, turbidity (sediment load), and chlorophyll-a (productivity).</p>	
<b>Findings and Status:</b> <p>2005 represented the thirteenth year of field sampling for this monitoring program and consisted of six surveys of twenty three stations located throughout Glacier Bay. Sampling during 2005 was conducted during January, March, June, July, October, and December. These time periods were chosen to represent spring bloom conditions (March), high chlorophyll-a levels (June and July), high stratification and turbidity levels (July), high precipitation conditions (October) and winter conditions (January, December). In addition, these months were chosen to give consistency in the timing of sampling among years. At each of the twenty-three stations during each of the sampling times, a vertical CTD profile of salinity, temperature, chlorophyll-a concentration (proxy for phytoplankton abundance), light penetration, and turbidity was taken at one meter intervals from surface waters to bottom depths (or maximum of 300m).</p> <p>Past oceanographic surveys combined with 2005 sampling in Glacier Bay demonstrate that oceanographic characteristics of the surface waters are relatively similar from November to February, while the periods March through October represent the greatest change, both spatially and temporally (among months). The upper-fjord regions of the Bay, located the farthest from marine waters and closest to glaciers, are the areas of greatest change among months of the year for all measured physical oceanographic factors except water temperature. Noticeable differences in oceanographic properties have been detected between the East and West Arms of the Bay, potentially due to differences in weather patterns between these regions as well as differences in sources of freshwater input and sediment loads. Patterns of salinity and stratification appear to be largely driven by the seasonal cycle of freshwater discharge in</p>	

southeast Alaska. High levels of freshwater discharge from upper Bay regions promote stratification from spring through fall, while strong tidal currents over shallow sills enhance mixing. Elevated levels of chlorophyll-a within the surface waters do not coincide with surface water stratification in May, but instead, an overall increase in chlorophyll-a occurs in March, most likely as a response to an increase in available light. Levels of chlorophyll-a increases from spring to summer and remains relatively high into the fall. Highest levels of chlorophyll-a within Glacier Bay are generally found within the central Bay and the lower reaches of the East and West Arms. These regions are likely favorable for phytoplankton populations due to intermediate stratification levels, higher light penetration due to decreased sediment concentrations in the water column, and nutrient regeneration.

In addition to oceanographic sampling this year, we also held a workshop to conduct an external review of the current operations of the oceanographic monitoring program and to develop recommendations for future work. An overview of the discussions and recommendations resulting from this workshop are currently being compiled.

#### 2005 Products

Madison, E. and L. Etherington. 2005. Monitoring of oceanographic properties of Glacier Bay, Alaska. 2004 Annual Report. U.S. Geological Survey, Anchorage, AK. An annual report submitted to National Park Service. 21pp.

Etherington, L., P. Hooge, E. Hooge. In Review. Oceanographic patterns in Glacier Bay: Implications for biological patterns and productivity. In: Piatt, J.F. and S.M. Gende (eds). Proceedings of the Fourth Glacier Bay Science Symposium, Juneau, AK, October 2004. U.S. Geological Survey Data Series Report.

Etherington, L., P. Hooge, E. Hooge. In Review. Oceanographic patterns in an Alaskan glacial fjord estuary: Implications for biological patterns and productivity. Estuaries.

**For this study, where one or more specimens collected and removed from the park but not destroyed during analyses?**

No

**Funding provided this reporting year by NPS:**

0

**Funding provided this reporting year by other sources:**

60000

**Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college**

**Full name of college or university:**

**Annual funding provided by NPS to university or college this reporting year:**

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